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Pasture and Soil Management Following Tidal Saltwater Intrusion

Tony Provin, Larry Redmon, Mark McFarland and Sam Feagley*

The Texas Gulf Coast is highly susceptible to tidal surges during hurricanes. Fortunately, significant inland flooding happens infrequently. But when these events do occur they decimate crop and pasture lands. The long-term effect of tidal surges on soil productivity is largely dependant on soil texture, the level of soil moisture before the surge, and the duration of the saltwater inundation. Following Hurricane Ike (September 2008), a significant amount of forage and row crop acreage was inundated by saltwater for 12 to 240 hours. Observations and soil tests made approximately 10 days after Hurricane Ike revealed the following:

- **Forages under saltwater for 24 to 48 hours:** Bermudagrass was recovering and most leaf tissue showed a healthy green color. Bahiagrass had some discoloration and curling of leaves. Some other species appeared to be brown and desiccated from exposure to salt water, although a number of weed species, including nutsedge, remained yellow green to green.
- **Forages under saltwater for 48 to 96 hours:** All bermudagrass leaf tissue appeared to be brown. This could have been due simply to the lengthy submersion of plants, or it could have been caused by prolonged exposure to the saltwater. There were some green stems and normal rhizomes, indicating the potential for recovery. Other species were brown and desiccated.
- **Forages and all other species under saltwater for more than 96 hours:** All bermudagrass leaf tissue appeared brown and many stems were also desiccated and broke under pressure. Rhizome health differed depending on sampling. All other desired forage species appeared dead.

Salinity levels will be reduced only by leaching with freshwater from either rain or irrigation. Salt leaches out of the upper soil profile most readily in sandier soils with good drainage. A more effective way of reducing salinity is through the dissolution of soil salts and the overland flow of salty water to drainage ways. This method requires that field edges and existing ditches and drainage ways be clear of debris.

Salinity may limit the establishment of winter forages and re-establishment of permanent forages in the short term. Many forages, such as ryegrass and most clover varieties, are relatively sensitive to higher salinity levels, while some species, such as bermudagrass, are more tolerant of salinity and flooding. The most important thing a producer can do at this time is to collect and submit a soil sample for a salinity test. An emergency campaign for tidal surge soil salinity assessment is being conducted by the Texas AgriLife Extension Service Soil, Water, and Forage Testing Laboratory at College Station. Forms for submitting soil samples are available from county offices of the Texas AgriLife Extension Service in the affected areas. The following laboratory recommendations apply only to soil samples to be collected for tidal surge-induced salinity analysis.

Soil Testing

Immediately after tidal water drains away, collect samples of surface soil, 0 to 3 inches deep, from each representative area. The shallower than normal sampling depth is used to evaluate the effect of the recent saltwater flooding and the potential for immediate revegetation.

*Associate Professor and Extension Soil Chemist, Professor and Extension Forage Specialist, Professor and Extension Soil Fertility Specialist, and Professor and Extension Soil Environmental Specialist, The Texas A&M System.

Each sample submitted to the laboratory should be a mixture of 10 to 15 individual subsamples from each representative area. A representative area is one with similar vegetation, soil texture and duration of saltwater flooding. The laboratory will analyze the sample using a simple 2:1 slurry method, thus allowing rapid sample turnaround. The laboratory report will give the producer an assessment of the soil salinity and the viability of various crops and forages at that soil salinity level. Table 1 indicates the effect on forage productivity, but does not indicate whether or not newly established forages will germinate or survive as seedlings on the salt-affected sites.

Proper soil pH and fertility are required to achieve the yield goals shown in the table. The Tidal Surge Soil Salinity Assessment will not provide routine soil fertility information or recommendations. This information can be determined only from a 0- to 6-inch-deep soil sample (producers should not use the 0- to 3-inch sampling depth for fertilizer recommendations). Available soil nitrogen is often leached by saltwater flooding, just as it is with freshwater flooding. However, the long-term effects of saltwater inundation can be minimized through good soil fertility and grazing management.

Revegetation Guidelines

Removal of Dead Standing Material

It will be difficult to establish winter or spring forages if dead standing material is left in a pasture. Remove this material

- to increase precipitation runoff, which helps remove some of the accumulated salt on the soil surface;
- to facilitate any seedbed preparation that may be required; and
- to enhance seed germination and keep seedlings from being shaded out by the dead standing material.

Prescribed fire is the best way to remove dead material. Before conducting a prescribed fire, however, be certain your county does not have a burn ban in effect (most affected counties along the Texas Gulf Coast are under burn bans) and carefully inspect the pasture to make sure there are no hazardous materials in the pasture or drainage way. Propane tanks, refrigerators, petroleum containers, tires and other debris may have been deposited by a tidal surge. When planning a prescribed fire, always make sure conditions are right, including ambient temperature, wind speed and relative humidity.

Table 1. Soil salinity tolerance levels for commonly used forage crops.

	Yield potential 2:1 EC umhos/cm				
Crop	**100%**	**90%**	**75%**	**50%**	**Maximum EC**
Ryegrass	1075	1525	1900	2425	2875
Sorghum	1750	2150	2800	3775	5175
Wheat	2425	2850	3400	4200	5525
Barley	2425	2850	3400	4200	5525
Bermudagrass	2700	3150	3725	4550	6025
Sudangrass	1250	2150	3175	4550	6475
Rye	2950	3275	4175	5175	6700
Oat	2100	2275	2525	2875	3525
Soybean	2100	2275	2500	2875	3525
Corn	700	1125	1675	2400	3525

Seedbed Preparation and Seeding

Attempt to establish forages only when the soil analysis shows the salinity level is appropriate. Depending on the soil type and degree of salt accumulation at a site, significant rainfall may be needed to reduce salt levels. A light disking usually will be beneficial because any organic residue that remains on the surface could keep broadcast seed from reaching the soil surface. Disking will also break up crusts that may have formed. These crusts prevent rain or irrigation from penetrating the soil and leaching away salts.

If the soil test for salinity indicates that ryegrass may be established, seed can be broadcast directly into the ash bed after a prescribed fire. However, a seedbed will need to be prepared for small grains (barley, wheat, rye and oat), sorghum-sudan hybrids or sudangrass. Thoroughly disk the area to be planted. Then use a drill to place the seed about ¾ to 1½ inches deep in the soil, or broadcast the seed onto the prepared seedbed and lightly disk the seed into the soil. Table 2 shows suggested seeding rates for some forages.

The degree of damage to warm-season perennial grass pastures cannot be fully assessed until spring green-up. At that time, producers will be able to identify the areas that need to be re-established. Success will depend on whether soil salinity in the affected areas has decreased to an acceptable level.

Table 2. Seeding rates for various forage crops.

Forage crop	Seedling rate (lbs/acre)
Ryegrass	30-40
Sorghum	25-40
Wheat	90-100
Barley	90-100
Bermudagrass	10-15
Sudangrass	25-30
Rye	90-100
Oat	90-100
Soybean	60-70
Corn	25-35

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